Space Weather Technical Forecast

Issued on Thursday, 13 June 2024 at 00:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares (R1-R2 radio blackouts). Chance of Minor solar radiation storm (S1) initially, this risk declining into the period.
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate, with an isolated M1.2 at 12/2246 UTC attributed to AR3711 near the south-centre disc. There are currently ten sunspot regions on the visible disc, three of which are unnumbered regions developing in the northeast. AR3709 is now considered to be a mature region, consisting of a single leader followed by smaller trailing spots and a relatively extensive plage. The region appears to be inactive, with little development. The largest regions are now AR3712 and AR3713, both in the southeast. Both have recently rotated onto the visible disc and while AR3713 appears to be the largest of the two, AR3712 is showing greater potential, with rapid development and increasing complexity. The other regions are relatively small and simple.

A filament eruption was observed around 12/1200 UTC in the southeast. The associated CME may have an Earth-directed component however there is currently no available imagery to do the analysis. No other Earth-directed CMEs have been observed in the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, were indicative of a slow regime. The speed was stable and slow-ambient, around 350km/s through the period, with below average density. The IMF (Interplanetary Magnetic Field), Bt, was weak and unremarkable throughout, with only slight deviations (-4/+5nT) of the north-south component, Bz. The phi angle was predominantly positive (away from the Sun), with only brief negative intervals (towards the Sun). Geomagnetic activity was Quiet (Kp 0-1) as a result.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 rose following the far-sided CME, almost reaching S1/Minor solar radiation storm levels. Levels have since levelled off but remain close to the S1 threshold, with no sign of abating.

High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels, with the associated 24-hour fluence well below Active. Observed fluence at 13/0000 UTC was 1.24e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 in the short term. The flare risk reduces into the period pending further developments.

Solar Wind / Geomagnetic Activity: Overall, solar winds are expected to remain mostly at background levels, with no significant enhancements, and geomagnetic activity to remain predominantly Quiet with a chance of Unsettled intervals.

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Space Weather Technical Forecast

Energetic Particles / Solar Radiation: High energy proton flux is currently close to S1/Minor solar radiation storm levels after a recent far-sided CME. It is expected to ease over the coming day but a chance for further enhancement remains, with the risk of S1 maintained for Day 1 (13 Jun), before easing over subsequent days.

High energy electron flux is forecast to persist at predominantly background levels, and the associated 24-hour fluence is expected to remain below the Active threshold.

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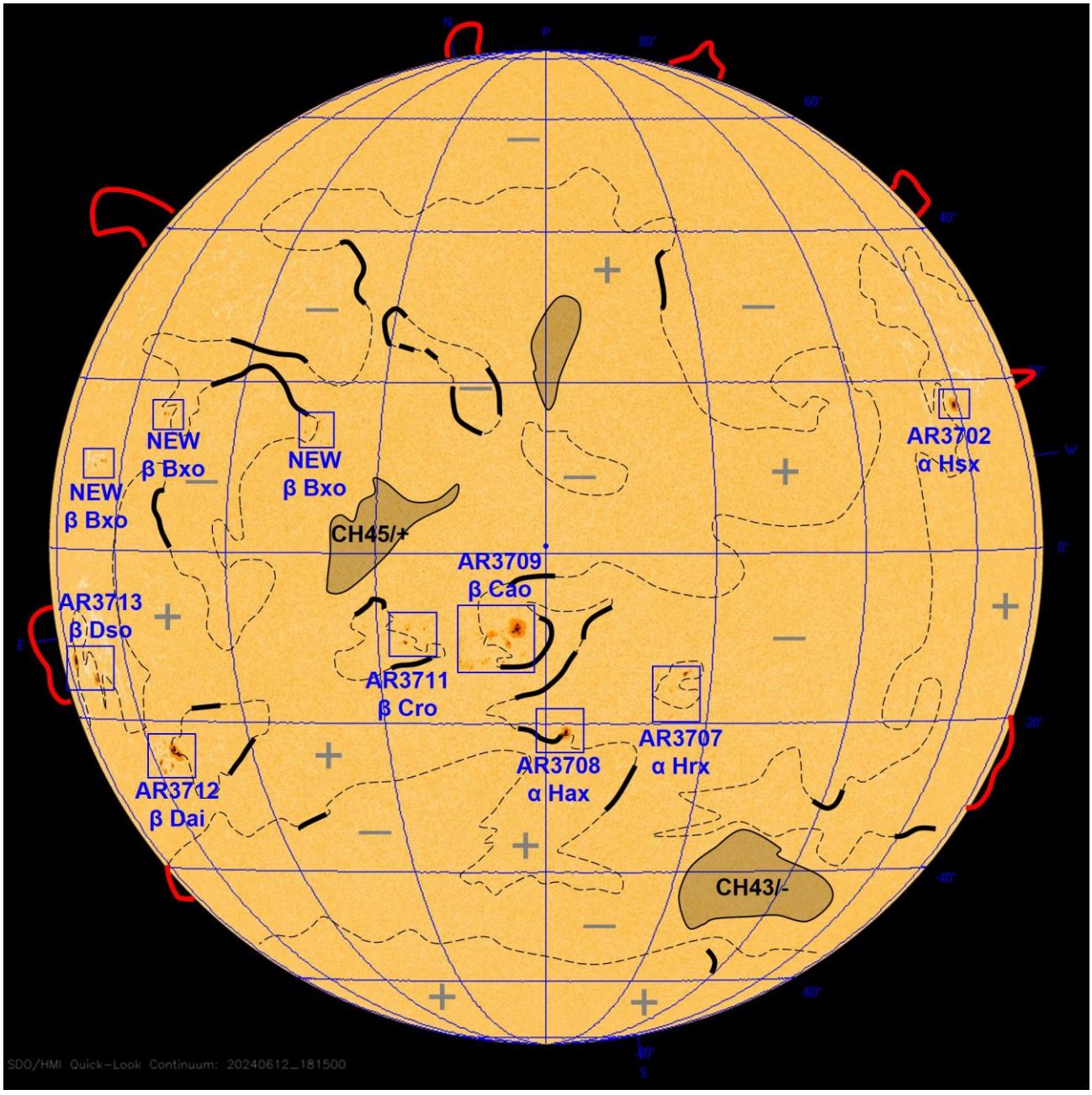
Figure 1. Solar Analysis Valid 12/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption was observed around 12/1200 UTC in the southeast. The associated CME may have an Earth-directed component however there is currently no available imagery to do the analysis. No other Earth-directed CMEs have been observed in the past 24 hours.

Solar wind speeds are now at background levels following recent CME influence and are expected to remain so through much of the period. A coronal hole (CH43/-), considered to be in a geoeffective location in the southwest, may connect with Earth in the next few hours. However it looks small and far from the centre disc, with limited geomagnetic response expected. Another small coronal hole has recently appeared near the north-centre disc. Its high speed stream may connect with Earth on Day 4 (16 June) but it's difficult to estimate the level of geomagnetic response given it was absent on the last rotation. Judging from its size though, it should not be able to bring much more than slightly elevated solar wind speeds and a few Unsettled geomagnetic intervals.

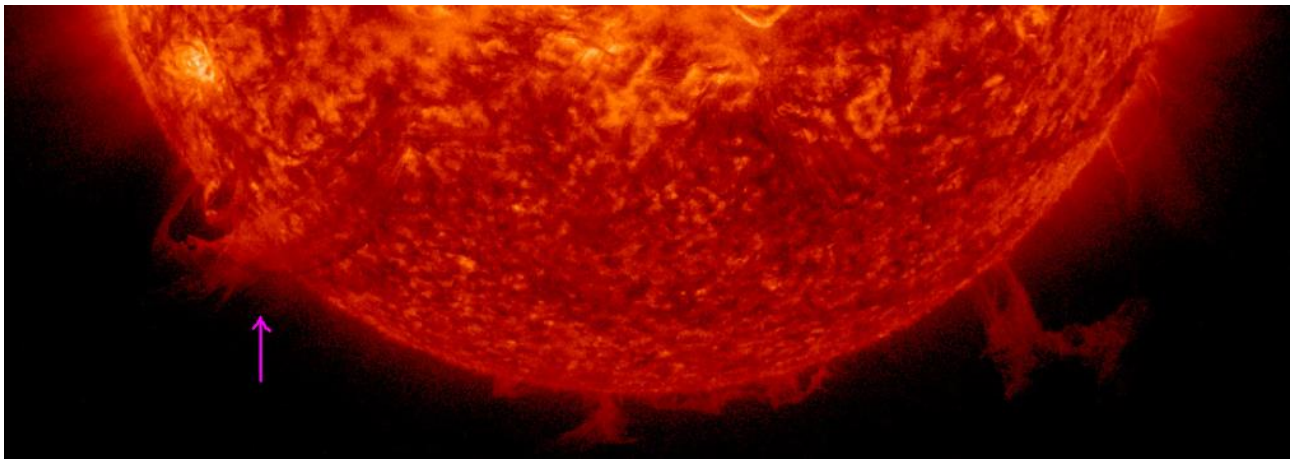
Overall, solar winds are expected to remain mostly at background levels, with no significant enhancements, and geomagnetic activity to remain predominantly Quiet with a chance of Unsettled intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

NIL

Figure 2: SDO aia-304 image from 12/1300 UTC showing the filament eruption in the southeast.



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Radio Blackouts - X-Ray Flares:
There are currently 10 sunspot regions on the visible disc, three of which are unnumbered regions developing in the northeast. AR3709 is now considered to be a mature region, consisting of a single leader followed by smaller trailing spots and a relatively extensive plage. The region appears to be inactive, with little development. The largest regions are now AR3712 and AR3713, both in the southeast. Both have recently rotated onto the visible disc and while AR3713 appears to be the largest of the two, AR3712 is showing greater potential, with rapid development and increasing complexity. The other regions are relatively small and simple.

There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 in the short term. The flare risk reduces into the period pending further developments.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X Class	No	10	5	1	1

Figure 3: Latest GOES-18 X-Ray Flare Activity showing the M1.2 at 12/2246 UTC.

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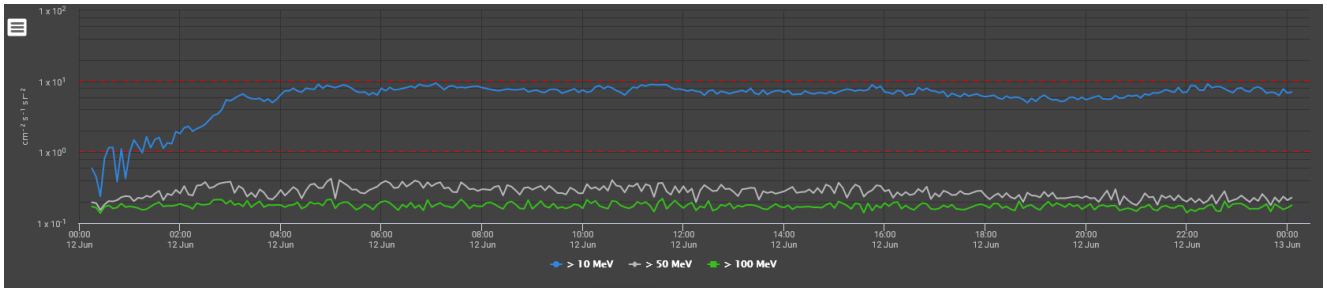
Solar Radiation Storms - (High Energy Protons):
Proton flux levels rose to almost S1/Minor solar radiation storm levels following a far-sided CME, probably from the AR3697 region that has rotated around the western limb in recent days. Proton flux is expected to come back down over the following days but remains close to the S1 threshold, so much so that any further flaring from AR3697 could easily result in a breach. The risk is considered possible on Day 1 (13 Jun) but unlikely on Day 2 (14 Jun) and thereafter.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	40	15	5	5
Very Active	**≥ S3 ***	No	5	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: Latest GOES-18 Proton Flux



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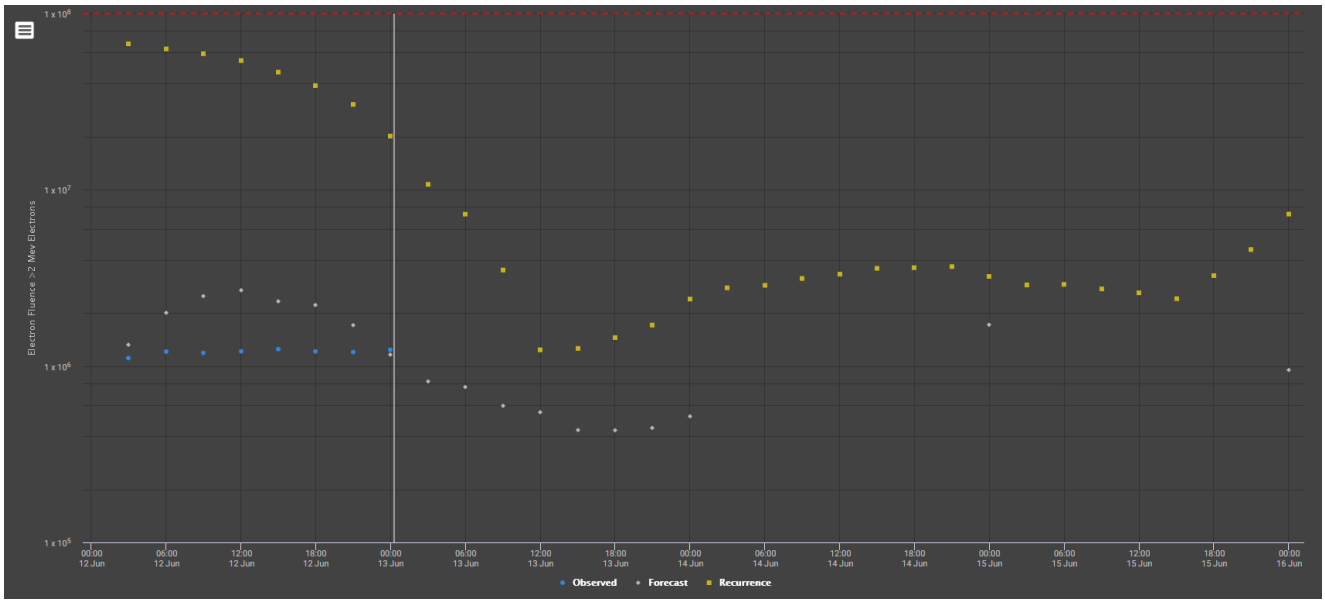
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux is expected to persist at generally background levels for much of this period with no or limited significant sources of enhancement expected. Some diurnal Moderate flux values becoming likely into the period however.

The associated 24 hour fluence is expected to remain well below the Active threshold (1e8 integrated pfu) and the MOSWOC REFM output is considered to provide reasonably good guidance, even if it seems to overestimate the levels.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: Latest MOSWOC REFM model



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